

## Web Cameras Provide Look at X-33 Vehicle Assembly

by Tony Jacob

Three Internet-linked cameras in California now provide Web browsers up-to-the-minute snapshots of construction of NASA's prototype for future space launch vehicles and work at its launch site.

Taking advantage of World Wide Web technology, the NASA X-33 Program has placed two digital cameras high above the X-33 assembly floor in Palmdale, Calif. A third camera looks out over the launch site at Edwards Air Force Base, Calif. The images captured by the cameras are featured on the Internet at NASA's X-33 Website.

The X-33 program is under the Space Transportation Programs Office at Marshall.

New images of the vehicle's construction are captured every 15 minutes and posted to the X-33's Website the following day. Images of construction of the 25-acre launch site also are captured every 15 minutes and are posted to the Web weekly.

All major integration milestones in the X-33's fast-paced assembly will be captured for Web surfers, including the



Photo courtesy Lockheed Martin Skunk Works

From a Web camera's vantage point high above the X-33 assembly floor, an image is captured of crews placing the X-33's liquid oxygen tank into the primary assembly structure. The 26-foot-long, 5,500-pound aluminum liquid oxygen tank that forms much of the nose and forward third of the X-33 vehicle was placed into the assembly facility April 19.

installation of the enormous aluminum liquid oxygen tank, which occurred April 19. Upcoming milestones that will be captured by the cameras include installation of the liquid hydrogen tanks in

midyear, followed by installation of the X-33's two linear aerospike engines, and eventually the vehicle's rugged metallic thermal protection system.

*See X-33 On the Web on page*

## Marshall Fastrac 'Family' Races for the Finish

by Deana Nunley

The Marshall-developed Fastrac engine — only the second space launch engine developed in the United States in the last 25 years — has moved into the assembly phase.

"This is making history at Marshall, so you can imagine how proud we are to be a part of it," said Danny Davis, manager of the Advanced Space Transportation Program's Low Cost Technologies project, which oversees development of the Fastrac engine.

The 60,000-pound-thrust engine, fueled by a mixture of liquid oxygen and kerosene, is scheduled to power the X-34 technology demonstration vehicle on its first flight in 1999.

### Faster, better, cheaper

Each Fastrac engine will initially cost approximately \$1.2 million — about one-fifth of the cost of similar engines. Once the engine is in mass production, that cost is expected to drop to about \$750,000.

*See Fastrac Engine on page 3*

## All-Hands Meeting Set for June 30 In Morris Auditorium

An All-Hands Meeting will be held at 10 a.m. Tuesday, June 30, in Bldg. 4200, Morris Auditorium. Employees who are unable to attend may view the meeting on Centerwide closed-circuit television.

## **FERS Transfer Issues to be Addressed June 24**

The Office of Personnel Management at Marshall is sponsoring a satellite broadcast noon-1:30 p.m. June 24 on the Federal Employees Retirement System (FERS) transfer issues. This broadcast will be transmitted to all closed-circuit television monitors and will be directed to all employees who are eligible to transfer to FERS. It is an interactive broadcast where questions may be directed to the panel by telephone or fax at the numbers provided at the beginning of the program.

## **Employees Should Not Disturb Wildlife Nesting Areas Around Marshall Center**

The Environmental Health Office at Marshall requests that employees avoid areas where significant wildlife nesting materials, excreta or other animal remains are found. Various forms of wildlife such as rodent and pigeons carry pathogens. Exposure to these microorganisms, such as viruses and bacteria, can cause diseases in humans. If signs of wildlife infestation are encountered, call Marshall's Environmental Health Office at 544-2390.

## **Physics Seminars on TV Continuing**

Physics for the Third Millennium seminar series is airing through June 30 on the Marshall Continual Learning Channel 14. The seminars cover a wide range of subjects including worm holes and warp drives, physics of antimatter and breakthrough propulsion physics. Programs air at 9 a.m., 11 a.m., 1 p.m. and 3 p.m. Monday through Friday. A complete schedule is available on the Web at: <http://inside/EODO/training/tvschedule.html>

## **McBrayer Appointed Deputy Director Of S&MA Office at Marshall Center**

Robert McBrayer has been appointed deputy director of Marshall's Safety and Mission Assurance Office. He formerly served in the Advanced Projects Office in Marshall's Program Development Directorate. Most recently, on special assignment, McBrayer served on the NASA Program Management Council Working Group.

McBrayer joined Marshall in 1966 as Skylab interface coordinator. He began his NASA career at Johnson Space Center in 1963.

## **Saucier to Serve Administratively for Center's S&MA Office Director**

Until further notice, Sid Saucier will act administratively for Amanda O. Harris, director, Safety and Mission Assurance Office. These duties will be in addition to Saucier serving as the Center's associate director. Harris, who recently gave birth to a son, will be on leave for an indefinite period.

# **Marshall Team Receives Award For Space Shuttle External Tank**

*by Deana Nunley*

Marshall was honored by the American Welding Society June 16 at the U.S. Space & Rocket Center for Marshall's development of the Space Shuttle external tank.

The American Welding Society selected the Center for the Historical Welded Structure Award because of the advanced technology and high quality of welding used in construction of the external tank from the propulsion test article. The tank was a significant piece of test hardware in verifying the design of the Shuttle's giant fuel tank.

"This is quite an honor to receive this prestigious award," said Parker Counts, manager of the External Tank project at Marshall, who accepted the award for the Marshall team. "It took a great team effort to design and build the external tank. The tank being recognized by the American Welding Society is the first manufactured for the Shuttle program. Since that time, we've had 91 flights of the external tank."

The Space Shuttle external tank provides propellants to the Shuttle's three main engines during the first eight-and-one-half minutes of flight and has performed flawlessly. At 154 feet long and more than 27 feet in diameter, the external tank is the largest single component of the Space Shuttle and the structural backbone of the system. It is the largest welded aluminum structure ever flown and has over one-half mile of welds.

The June 2 launch of the STS-91 mission was the maiden flight of the new, super lightweight external tank. The new tank weighs about 7,500 pounds less than the tank it replaced — a weight reduction that was necessary for launching heavy components of the International Space Station for assembly on orbit. The tank, on display with a full-scale mock-up of the Shuttle orbiter and solid rocket boosters at the Space & Rocket Center, is manufactured by Lockheed Martin at the Michoud Assembly Facility in New Orleans.



NASA Photo by Adeline Byford

## **Canadian Space Agency Members Tour Center**

Members of the Canadian Space Agency observe a glovebox demonstration at Marshall's Microgravity Development Laboratory during a visit June 10. The group also received presentations on space tethers and space solar power and toured the Payload Operations Integration Center and the Space Station Manufacturing Facility.



# Fastrac Engine

*Continued from page 1*

The engine's low cost is the result of a shorter-than-usual development cycle, relatively simple design features and commercial, off-the-shelf components.

Developing a new rocket engine has traditionally taken about 10 years. But the Marshall team started designing the Fastrac engine less than two-and-one-half years ago and the first full-engine, hot-fire test is just a few months away.

Building the Fastrac is relatively easy because it has significantly fewer parts than other American rocket engines. For instance, the Fastrac has a three-piece injector — a sharp contrast from typical injectors with hundreds of pieces.

"The Fastrac engine is an elegant machine," Davis said. "Marshall has stepped up to the challenge of taking the dollars out of the single most expensive element of a launch vehicle — the engine — by confronting risks without adding complexity."

And with creation of an engine that could power the next generation of space launch vehicles, a new generation of engineers has emerged at the Marshall Center.

"We've leaned on the experience and expertise of the 'graybeards,' but the majority of the people doing the work are young engineers," said Karen Spanyer, team lead for the structural assessment of the engine.

"We've compared it to the Saturn days. They were young and look at what they did," Spanyer said. "We're the first

generation with this new technology and elaborate tools to expedite the process of design analysis and manufacturing, and we feel like we're breaking new ground."

## A Marshall First

Fastrac marks the first time Marshall has developed a rocket engine in-house.

"Marshall is not providing oversight. We're actually doing the work," said Jeff Sexton, a Mission Operations Laboratory member of the Fastrac team.

"In a way, we control our own fate because we're responsible for getting the job done. Everybody on the team is highly motivated and enjoys working the project."

Stress analyst Pravin Aggarwal is lending Fastrac the knowledge he's gained working with the Space Shuttle Main Engine the last 10 years.

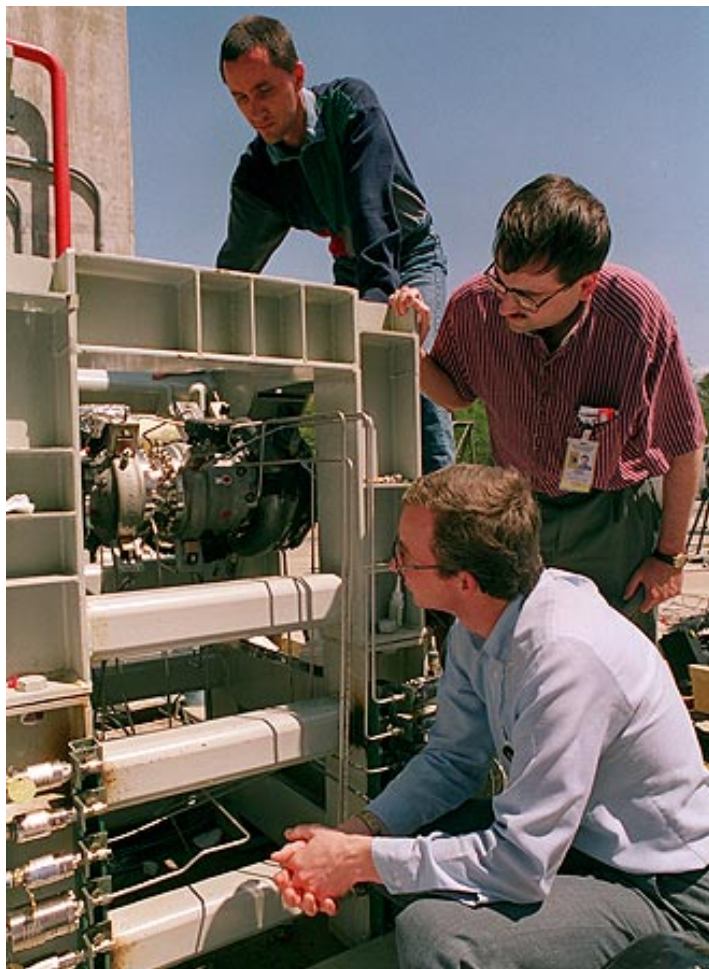
"What makes it most exciting to me is

getting involved in each phase — design, building, operations and specifications — not just monitoring or modifying or

*See Fastrac Engine on page 4*

Below, some members of the Fastrac team are, from left, Tim Lawrence, Tom Byrd, Mike Ise, Warren Peters, Mark Fisher, George Young, Richard Sheppard, John Hutt, Les Alexander, Charlie Nola, kneeling, and Danny Davis.

Nasa Photo by Dennis Olive



Nasa Photo by Dennis Olive

Above, Marshall employees Wayne Samwell, top; John Forbes, center and Wayne Gregg inspect the Fastrac turbopump in Test Stand 116.



# Fastrac Engine

*Continued from page 3*

operating an engine," said Aggarwal. Aggarwal, primarily a troubleshooter throughout the development of Fastrac, said the team is doing a good job resolving technical issues and he believes it will be a good engine.

## Cooperative Effort

Davis says the key to Fastrac's success has been a cooperative effort to combine all the necessary disciplines and focus on an excellent product.

"The team has done an enormous amount of hard work to overcome very difficult technical challenges," said Davis. "This team has confronted problems and resolved them with good engineering analysis and design, while holding on to our initial goal of building extremely low-

cost hardware that works."

More than 200 NASA and contractor employees have contributed to design and development of the Fastrac engine.

"It's absolutely amazing to see a large diversified group — design, analysis, manufacturing and all these different types of engineers — bond together to get the job done," said Spanyer. "The initial issues and conflicts were worked out in a short amount of time, and now it's as though it's the 'Fastrac engine family.'"

Component testing continues at Marshall with Fastrac turbopump tests under way. The Fastrac will be shipped to NASA's Stennis Space Center, Miss., later this year for full-engine tests that simulate launch with the tanks and engine connected.



NASA Photo by Dennis Olive

Fastrac team members Wendy Cruik, left, and David Sparks help with assembly of the first Fastrac engine.

*"I think it's probably one of the greatest propulsion design teams since Saturn."*

—Mike Ise

Fastrac 60K product development team lead, Propulsion Laboratory

*"The Fastrac team is composed of some of the best engineers and technicians in the Marshall laboratories. And they have been willing and eager to take 'ownership' and give 110 percent to achieve the difficult objectives of this project."*

—George Young

Fastrac chief engineer Space Transportation Systems

*"The majority of the team are young engineers. A lot of them are getting first-time experience on developing real hardware, and everybody seems to be having a good time of it."*

—Charlie Nola

Avionics system product development team lead Astrionics Laboratory

*"It truly has been a career highlight. This has been my first time to help build a turbopump from start to finish."*

—Shawn Fears

Turbomachinery component development team lead Propulsion Laboratory

*"It's really rewarding to run a test and see everything you designed working so you can predict how it's going to run on an engine in flight."*

—Mary Beth Koelbl

Turbopump test coordinator Propulsion Laboratory

*"I think we'll have a good engine. I'm really excited about it. It's been a very useful tool for the young engineers to cut their teeth on, and we've learned a lot from a management standpoint on how to manage all this."*

—Mike Morelan

Change package engineer Systems Analysis and Integration Laboratory



## Upcoming Events

### 'Take Our Children to Work' Set for June 25 at Marshall Center

Marshall Center's "Take Our Children to Work Day" celebration is set for Thursday, June 25.

This day is designed for employees' children in grades 3-12. Children will be offered a firsthand look at their parents on the job.

Celebration activities will include a Center tour, and children will be given the opportunity to have their photographs taken.

More information about "Take Our Children to Work Day" is available from Marshall's Equal Opportunity Office in Bldg. 4200, room 220.



NASA Photo

### Agency Presents Flight Safety Award to Marshall Employee

Dr. Fayssal Safie of Marshall's Systems Safety and Reliability Office, received the Flight Safety Award from Fred Gregory, Associate Administrator for Safety & Mission Assurance, Headquarters. It was presented at the STS-91 Space Flight Awareness Honoree Reception June 1 in Cape Canaveral, Fla. At the reception were, from left, Ed Kiessling, Safety & Mission Assurance Office; Safie; Associate Administrator for Space Flight Joe Rothenberg; Acting Center Director Carolyn Griner and Gregory.

## X-33 On the Web

*Continued from page 1*

Camera A's focus is on the vehicle's primary assembly structure. On the left side of the image sits the X-33's 26-foot-long liquid oxygen tank cradled in a series of composite beams. The tank forms the forward third of the vehicle. The black vertical surface on the right is the vehicle's aft assembly structure, where the two linear aerospike engines will be mounted. The X-33 will take shape at this location on the assembly floor, and is scheduled to roll out from this spot in May 1999.

The image from Camera B shows side-by-side tooling structures for, in the foreground, the X-33's upper thermal protection system, and in the center, the vehicle's upper internal support structure.

The X-33 launch facility camera looks down from Haystack Butte, a steep hill located roughly a half mile south of the launch site. The camera captures images of the ongoing construction on the site. Construction began in November and is scheduled for completion in the fall of 1998.

The camera's focus is centered on the location for the vehicle's launch pad. The left side of the image currently shows construction of the launch site's 250,000-gallon water tower on the west side of the 25-acre facility. A deluge stream of water

### X-33 Website Access

To access the images, visit the X-33 Web site at:  
<http://x33.msfc.nasa.gov>

From the opening page:

- ◆ Click on the "Internet Cameras" hyperlink text
- ◆ Click on the month containing the images you'd like to view
- ◆ Click on the day

A screen will appear with times of the day linked to corresponding images.

- ◆ Click on a time to view the status of the X-33 assembly at that moment.

A faster way to access the images is to go directly to the page featuring the "clickable" months:  
<http://stp.msfc.nasa.gov/cameras/camera.html>

will be used for cooling and sound suppression at launch.

The camera page even features a link to a map of the X-33 assembly floor so Web visitors can determine which areas of the assembly floor they're viewing.

The X-33 is NASA's flagship technology demonstrator and is being developed under a cooperative agreement between NASA and Lockheed Martin Skunk Works, Palmdale, Calif., which began July 2, 1996.

The wedge-shaped X-33 is a subscale technology demonstration prototype of a reusable launch vehicle which Lockheed Martin has labeled "VentureStar™," and which the company hopes to develop early in the next century. Through demonstration flights and ground research, NASA's X-33 program will provide the

information needed for industry representatives such as Lockheed Martin to decide whether to proceed with the development of a full-scale, commercial reusable launch vehicle.

Vehicle assembly continues on a fast pace through spring 1999, when the X-33 is scheduled to roll out from the assembly facility.

The first of the X-33's 15 test flights is scheduled to occur in July 1999.

## Employee Ads

### Miscellaneous

- ★ Complete IBM Thinkpad 355C lap-top system, 33 KBS modem, portable HP printer carrying case, \$850. 882-1780
- ★ PowerBook 3400c 200/80, active matrix, 2.1GB hard drive, 6x CD-ROM, 33.6K modem, \$3,000. 881-5389
- ★ Square dance dresses and slips, size 12, \$8 each. 729-6301
- ★ Rhododendron hybrid seedlings, ARS seeds, one year old, \$2 each. 881-7953
- ★ Hewlett Packard 200LX palm-top, 2x speed, 10MB flash card, A/C adaptor, Mac accessories, \$250. 881-5389
- ★ Books on tape, bestsellers priced from \$2 to \$8 each. 534-1010
- ★ Dryer, Maytag heavy-duty, \$150. 881-0551
- ★ Mini van cover for Pontiac, Chevrolet or Oldsmobile, \$40. 882-9417
- ★ Large selection infant clothes, 3 months to 2-T, \$.25 to \$5; ladies clothes sizes 8-14. 653-4266
- ★ Butler Creek 10/22 synthetic stocks for bull barrel, \$30 each. (931) 438-0476
- ★ Cypress Garden Dick Pope Jr. combo skis, \$60; ski vest, \$20; marine radio, \$60. 837-5782
- ★ Weber kettle grill w/cover, \$35; Sears washer/dryer, \$200; range top w/hood, \$50. 881-6040
- ★ Two companion crypts, Faith Memorial Park, \$500 below current selling price, 5-foot landscape box. 771-0797
- ★ Antique 45" round oak pedestal table, \$325; cherry wall unit \$125; home/office desk, \$125. 534-7880

### Autos

- ★ 1991 Ford Taurus GL/V6, blue, 4-dr., AC/PW/PL, AM/FM cassette, 119K miles, leave message. 830-8354
- ★ 1955 Chevy Belair 4-dr., 6-cyl, turquoise/white show car, runs, 3-spd., \$9,900 o.b.o. 830-5479
- ★ 1994 Mustang Cobra, black/black, leather, new tires, 22K miles, 5-spd., all options, \$13,500 o.b.o. 726-2529
- ★ Honda CBX classic motorcycle, many options, \$4,000. 837-6109
- ★ 1990 Ford Taurus SHO, leather, all options,

low miles, \$6,450. 837-6109

- ★ 1993 Toyota Camry XLE, 65K miles, V-6, leather, \$13,500. 534-3777
- ★ 1988 Honda Accord LX, 4-dr., 5-spd., 135K miles, AC, \$3,100. 837-0085

### Wanted

- ★ Children's play kitchen center. 837-6838
- ★ TI-59 calculator w/wo printer mag card reader/writer, must work properly. 837-6776
- ★ Hard drive for PC, 800-2MG. 883-2757

### Free

- ★ Female terrier, black, 9 mo. old to loving home, shots, spayed, no small children, after 5:30 p.m. (205) 498-2116

## Center Announcements

- ✦ **MESA** — The Marshall Engineers & Scientists Association (MESA), IFPTE Local 27, will meet at 11:30 a.m. Thursday, June 18 at the northeast end of Bldg. 4471, room C-105.
- ✦ **Shuttle Buddies** — The Shuttle Buddies will meet for breakfast at 9:15 a.m. June 22 (each fourth Monday) at Shoney's on University Drive West. Contact: Deemer Self, 881-7757
- ✦ **NAFRE** — The National Association of Retired Federal Employees (NARFE), Chapter 736 will meet at 11 a.m. Wednesday, June 24, at Morrison's Cafeteria in Decatur. Susie Brown, volunteer co-coordinator for Parkway Medical Center Hospital, will speak. All retired federal employees are encouraged to attend. Contact: 355-2874 or 773-4826
- ✦ **Toastmasters** — The NASA Lunar Nooners Toastmasters Club will meet at 11:30 a.m. Tuesday, June 23 in Bldg. 4610's cafeteria conference room. All Marshall employees, contractors and friends are invited. Contact: Debbie Hagar, 539-4499 or Lee Johns, 544-5142
- ✦ **Blacks In Government** — A special meeting for Blacks In Government members is set for 11 a.m. June 22 in the

Sparkman Bldg. 5309, room 9128.

Important matters will be discussed and all members are encouraged to attend.

- ✦ **Surplus Auction** — An industrial public surplus auction for NASA will be held at 9 a.m. Saturday, June 20 at Bentley's at 1025 Jordan Road. Property may be inspected on Thursday, Friday and Saturday. Contact: 859-9031

- ✦ **Pepsi Product Sale** — The NASA Exchange will be selling Pepsi products left over from Marshall's Open House 1-3 p.m. June 25 in Bldg. 4471. Cases of 20 ounce Pepsi, Diet Pepsi and Mountain Dew will be available at \$11/case.

- ✦ **Travel Office** — The American Express Travel Office at Marshall in Bldg. 4203, suite 1109 will close an hour earlier on Monday, June 22. Phones will be answered by the after-hours number after the office closes for the day at 3:30 p.m. Contact: American Express Travel, 544-3946 or fax, 544-9367

## Job Opportunities

- CPP 98-67-DC, Program Analyst, GS-343-13 (2 vacancies)**, Microgravity Research Program Office, Program Planning and Control Office. Closing extended to June 17.
- CPP 98-71-CP, AST, Aerospace Flight Systems, GS-861-14**, S&E, Systems Analysis and Integration Laboratory, Technical Staff Office. Closes June 19.
- CPP 98-81-CV, AST, Mission Operations Integration, GS-801-14**, Flight Projects Office, Space Station Development Office. Closes June 24.
- CPP 98-61-PL, AST, Mission Support Requirements and Development, GS-801-14**, S&E, Mission Operations Laboratory, Training & Crew Systems Division, Training Branch. Closes June 22.
- CPP 98-63-CP, Management Support Assistant (OA), GS-303-7**, Office of the Chief/Financial Officer, Systems Processes Office. Closes June 26.
- CPP 98-80-DC, AST, Aerospace Flight Systems, GS-861-14**, Microgravity Research Program Office, MSFC, Science & Applications Project Office. Closes June 26.

# MARSHALL STAR

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